# Grade 7 Standards and Learning Activities

**Strand: Number Sense and Operations**

## NUMBER SENSE

**7.NSO–N.1.** Compare, order, estimate, and translate among integers, fractions, mixed numbers (i.e., rational numbers), decimals, and percents.

**7.NSO–N.2.** Know that in decimal form, rational numbers either terminate or eventually repeat; locate rational numbers on the number line; convert between common repeating decimals and fractions.

**7.NSO–N.3.** Know the concept of absolute value (e.g., $|-3| = |3| = 3$).

**7.NSO–N.4.** Represent numbers in scientific notation (positive powers of 10 only), and use that notation in problem situations.

*Example: Compute the following number:*

$$3.75 \times 10^{2} + \frac{7 \times 10^{4}}{3.5 \times 10^{2}}$$

*(See also 7.NSO-N.16)*

**7.NSO–N.5.** Differentiate between rational and irrational numbers (i.e., know that irrational numbers cannot be expressed as the quotient of two integers and cannot be represented by terminating or repeating decimals).

**7.NSO–N.6.** Interpret positive whole-number powers as repeated multiplication and negative powers as repeated division or multiplication by the multiplicative inverse. Simplify and evaluate expressions that include exponents.

**7.NSO–N.7.** Apply number theory concepts, including prime factorization and relatively prime numbers, to the solution of problems.

*Example: Find the prime factorization of whole numbers, and write the results using exponents:*
*$24 = 2 \times 2 \times 2 \times 3 = 2^3 \times 3$.*

**7.NSO–N.8.** Express ratios in several ways (e.g., 3 cups to 5 people; 3:5; 3/5); recognize and find equivalent ratios.

**7.NSO–N.9.** Know the meaning of a square root of a number and its connection to the square whose area is the number.

## COMPUTATION AND OPERATIONS

**7.NSO–C.10.** Compute with fractions (including simplification of fractions), integers, decimals, and percentages (including those greater than 100 and less than 1) using the four operations and combinations of the four operations.

**7.NSO–C.11.** Demonstrate an understanding of the properties of arithmetic operations on rational numbers (integers, fractions, and terminating decimals); convert terminating decimals into reduced fractions.

**Strand: Number Sense and Operations** *(continued)*

COMPUTATION AND OPERATIONS (CONTINUED)

**7.NSO–C.12.** Select and use appropriate operations — addition, subtraction, multiplication, division — to solve problems with rational numbers and negative integers.

*Example: Your task is to move 100,000 tons of cement from Davenport, Iowa, to St. Cloud, Minnesota. Davenport is on the Mississippi River. You have a choice of moving this bulk product by barge, truck, rail, or a combination (intermodal) of these.*

*Information about choices:*

*A. A truck can move 25 tons at a time and the direct cost is $20 per ton.*

*B. A railroad car can hold 100 tons and a 100-car train can carry 10,000 tons. The direct cost by this mode is $10 per ton, plus $1 per ton to unload in St. Cloud.*

*C. A barge can carry 1,500 tons and tow barges (15) can carry 22,500 tons in one trip at a cost of $5 per ton as far as Minneapolis. This is the end of the commercial navigation on the river. From here, the cement would have to be transferred to truck at a cost of $1 per ton. The last 70 miles by truck would cost $3.95 per ton to be delivered in St. Cloud.*

*Assuming that this is not a "just in time" movement and there is adequate storage in St. Cloud, what is the least costly mode or combination of modes to deliver this shipment of cement?*

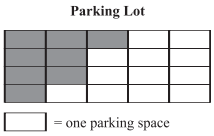
*(See also 7.NSO-C.18)*

**7.NSO–C.13.** Calculate the percentage increase and decrease of a quantity.

**7.NSO–C.14.** Use ratios and proportions in the solution of problems involving unit rates, scale drawings, and reading of maps.

*Example: Use the picture to answer the question below.*

*The shaded parts of the diagram represent the spaces that are reserved. What percent of the spaces is reserved?*




**7.NSO–C.15.** Take positive and negative rational numbers to positive whole number powers.

**7.NSO–C.16.** Apply the laws of exponents to multiply whole number positive and negative powers of whole numbers; divide whole number powers with like bases; explain the inverse relationship between negative and positive exponents.

**7.NSO–C.17.** Use the inverse relationships of addition/subtraction and multiplication/division to simplify computations and solve problems (e.g., multiplying by 1/2 or 0.5 is the same as dividing by 2).

**7.NSO–C.18.** Use the associative, commutative, and distributive properties; properties of the identity and inverse elements (e.g., –7 + 7 = 0; 3/4 x 4/3 = 1) to solve problems.

**7.NSO–C.19.** Know and apply the Order of Operations rules to expressions involving powers and roots.

ESTIMATION

**7.NSO–E.20.** Estimate results of computations with rational numbers; determine estimates to a certain stated accuracy.

**Strand: Patterns, Relations, and Algebra**

**7.PRA.1**. Extend, represent, analyze, and generalize a variety of patterns with tables, graphs, words, and, when possible, symbolic expressions. Include arithmetic and geometric progressions (e.g., compounding).

*Example: Use the given table to answer the following question:*

| *Term* | *1st* | *2nd* | *3rd* | *4th* | *5th* | *6th* |
|---|---|---|---|---|---|---|
| *Value* | *?* | | *24* | *35* | *48* | *63* |

*The 3rd, 4th, 5th, and 6th terms of the sequence are given in the table. What number belongs in the first and second positions of the sequence?*

*Example: Which table is based on the following rule?*

*First, square the number and then subtract the input number from its square.*

| | | | | |
|---|---|---|---|---|
| *A.* | *Input (x)* | *1* | *2* | *5* |
| | *Output (y)* | *1* | *4* | *20* |
| *B.* | *Input (x)* | *1* | *2* | *5* |
| | *Output (y)* | *0* | *4* | *25* |
| *C.* | *Input (x)* | *1* | *2* | *5* |
| | *Output (y)* | *1* | *2* | *25* |
| *D.* | *Input (x)* | *1* | *2* | *5* |
| | *Output (y)* | *0* | *2* | *20* |

*(See also 7.PRA.2)*

**7.PRA.2.** Evaluate simple algebraic expressions for given variable values (e.g., $3a^2 - b$ for $a = 3$ and $b = 7$).

*Example: The following formula can be used to calculate the monthly payment,* M, *on a loan:*

$$M = \frac{P(rt+1)}{12t}$$

*Where* P *is the principal,* r *is the annual rate, and* t *is the length of the loan in years.*

*Based on this formula, what is the monthly payment on a 2-year loan for $3,000 at an annual rate of 8%?*

*(See also7.NSO-C.13)*

**7.PRA.3.** Use the correct order of operations to evaluate expressions (e.g., $3(2x) = 5$).

**Strand: Patterns, Relations, and Algebra** *(continued)*

**7.PRA.4.** Create and use symbolic expressions for linear relationships, and relate them to verbal and graphical representations.

*Example: Use the following table:*

| Input | 3 | 4 | 5 | 6 | ... | n |
|---|---|---|---|---|---|---|
| Output | 10 | 13 | 16 | 19 | ... | ? |

*If* n *is the input, what will the output be?*

*A.* n + 3

*B.* n + 7

*C.* 3(n + 2) + 1

*D.* 3n + 1

*Example: If 4 + 2(3x – 8) = 8 , then 3x – 4 is equal to*

*A.* 4.

*B.* 2.

*C.* 8.

*D.* 6.

*Example: Some eighth-grade students want to raise at least $300 for a field trip by selling popcorn and fruit bars. The chart below shows the amount of profit they will make on each sale.*

| | *Profit from Sales* |
|---|---|
| *Box of popcorn* | *60¢* |
| *Fruit bar* | *30¢* |

*a. If they sell exactly 500 fruit bars, how many boxes of popcorn will they need to sell to make a total of $300?*

*b. Draw a graph showing the combinations of boxes of popcorn and fruit bars they must sell to make a total of exactly $300. Let the horizontal axis represent the number of fruit bars. Label that axis to 1,000. Show or describe the calculations you used to find the data points for your graph.*

*c. Based on last year's sales, the students will probably not be able to sell more than 600 fruit bars. Using your graph, explain how you can find the number of boxes of popcorn the students must sell to make a total of $300 if they sell exactly 600 fruit bars. How many boxes of popcorn must they sell?*

*(See also 7.PRA.5, 7.PRA.6)*

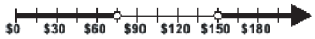
**Strand: Patterns, Relations, and Algebra** *(continued)*

**7.PRA.5.** Use variables and appropriate operations to write an expression, equation, or inequality that represents a verbal description (e.g., 3 less than a number, 1/2 as large as area *A*).

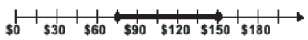
*Example: Imelda will work 10 to 20 hours per week at her new job and will be paid $7.50 per hour. Which of the following shows how much she can earn per week?*

*A.*

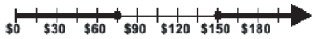

*B.*




*C.*




*D.*




*Example: The sophomore class plans to sell T-shirts with the school's name on them. The cost of each T-shirt alone is $3.50, and the printing cost of each is $0.75. If the class plans on selling each printed T-shirt for $11, what expression can you use to calculate the class profit for selling* n *printed T-shirts?*

*A.* n*11.00 - (3.50 - 0.75)*n

*B. 11.0*n *- (3.50 - 0.75)*

*C. 11.00 - 3.50 - 0.75*n

*D. (11.00 - 3.50 - 0.75)*n

*(See also 7.PRA.8)*

**7.PRA.6.** Write and solve two-step linear equations and check the answers.

*Example: Which of the following describes one way to solve the given equation?*

$12 - 3x = 5$

*A. Add 3*x *to both sides, then divide both sides by 3.*

*B. Subtract 3*x *from both sides, then multiply both sides by 3.*

*C. Add 12 to both sides, then multiply both sides by –3.*

*D. Subtract 12 from both sides, then divide both sides by –3.*

*(See also 7.NSO-C.17, 7.PRA.9)*

**7.PRA.7.** Identify, describe, and analyze linear relationships between two variables. Compare positive rate of change (e.g., $y = 3x + 1$) to negative rate of change (e.g., $y = -3x + 1$).

**7.PRA.8.** Use linear equations to model and analyze problems involving proportional relationships.

*Example: In John's homeroom, 1/3 of the students walk to school and 1/4 come by car. The remaining 15 come by school bus. How many students are in his homeroom?*

*(See also 7.PRA.4, 7.PRA.5)*

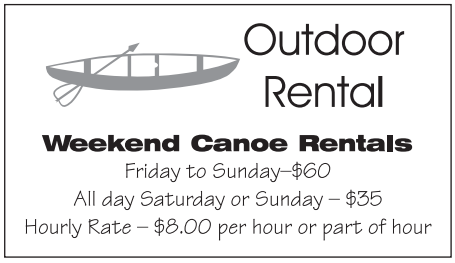
**7.PRA.9.** Simplify numerical expressions by applying properties of rational numbers (e.g., identity, inverse) and operations of rational numbers (distributive, associative, commutative); justify the process used.

**7.PRA.10.** Use algebraic terminology including, but not limited to, variable, equation, term, coefficient, inequality, expression, and constant.

**Strand: Patterns, Relations, and Algebra** *(continued)*

**7.PRA.11.** Plot the values of quantities whose ratios are always the same (e.g., cost to the number of an item, feet to inches, circumference to diameter of a circle). Fit a line to the plot and understand that the slope of the line equals the quantities.

*Example: Use the advertisement below to answer the following questions.*




*Marco wants to rent a canoe from 9:00 A.M. to 1:30 P.M. on Saturday. Is it better to rent for the day or by the hour?*

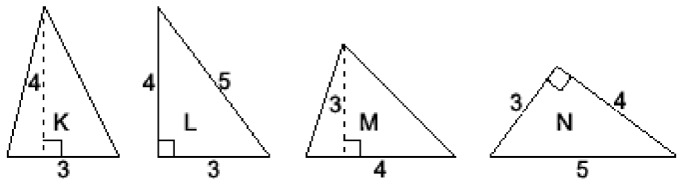
**Strand: Geometry**

**7.G.1.** Identify three-dimensional figures (e.g., prisms, pyramids) by their physical appearance, distinguishing attributes, and spatial relationships such as parallel faces.

**7.G.2.** Demonstrate an understanding of conditions that indicate two geometrical figures are congruent and what congruence means about the relationships between the sides and angles of the two figures.

**7.G.3.** Classify figures in terms of congruence and similarity, and apply these relationships to the solution of problems.

*Example: Use the figure below to answer the following question:*




*Which triangles are congruent?*

*a. K and M only*

*b. L and N only*

*c. K, L, M, and N*

*d. No two figures shown are congruent.*

*(See also 7.G.2)*

**Strand: Geometry** *(continued)*

**7.G.4.** Know and understand the Pythagorean theorem and its converse. Apply the theorem to the solution of problems, including using it to find the length of the missing side of a right triangle, and perimeter, area, and volume problems.

**7.G.5.** Use compass, straightedge, and protractor to perform basic geometric constructions to draw polygons and circles.

*Example: Use the ruler and protractor included in your reference sheet and the table below to answer the following questions:*

*A* **right** *triangle has one right angle.*

*An* **isosceles** *triangle has at least 2 congruent sides.*

*An* **acute** *triangle contains three acute angles.*

*An* **obtuse** *triangle contains one obtuse angle.*

*a. Is it possible to draw a right triangle that is isosceles?*

- *If it is possible, draw such a triangle. Label the parts of the triangle that make it right and isosceles.*
- *If it is not possible, explain why it is not possible.*

*b. Is it possible to draw an acute triangle that is isosceles?*

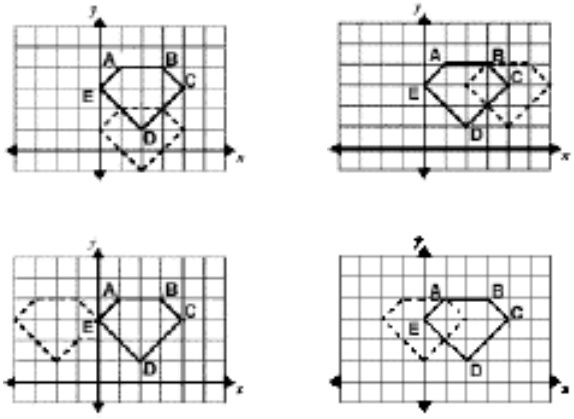
- *If it is possible, draw such a triangle. Label the parts of the triangle that make it acute and isosceles.*
- *If it is not possible, explain why it is not possible.*

*c. Is it possible to draw a right triangle that is obtuse?*

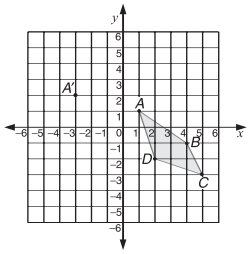
- *If it is possible, draw such a triangle. Label the parts of the triangle that make it right and obtuse.*
- *If it is not possible, explain why it is not possible.*

**7.G.6.** Understand and use coordinate graphs to plot simple figures; determine lengths and areas related to them; and determine their image under translations, reflections, and rotations (e.g., predict how tessellations transform under translations, reflections, and rotations).

*Example: Which of the following shows the translation of pentagon ABCDE two units to the left?*




*Example: Use the following figure to answer the question below.*




*If Figure ABCD is translated so that the image of A is A' at (-3,2), what are the coordinates of the image of point B?*

**Strand: Measurement**

**7.M.1.** Select, convert (between systems of measurement), and use appropriate units of measurement or scale.

*Example: For each of the following, convert to the units indicated.*

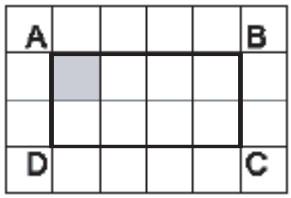
*A. 1,250 meters = _____ kilometers*

*B. 12 quarts = _____ gallons*

*C. 10 cubic feet = _____ cubic inches*

**7.M.2.** Demonstrate an understanding of the concepts and apply formulas and procedures for determining measures, including those of area and perimeter/circumference of parallelograms, trapezoids, and circles. Given the formulas, determine the surface area and volume of rectangular prisms and cylinders.

*Example: If the area of the shaded square is 5 $cm^2$, what is the perimeter of figure ABCD?*




*(See also 7.M.4)*

**7.M.3.** Demonstrate an understanding that rate is a measure of one quantity per unit value of another quantity; use models, graphs, and formulas to solve simple problems involving rates (e.g., velocity and density); check the units of the solutions; use dimensional analysis to check the reasonableness of the answer.

**7.M.4.** Construct and read drawings and models made to scale.

*Example: On a map of the school, the gymnasium is 10 cm long and 6 cm wide. The actual gymnasium is 25 m long. How wide is the gymnasium?*

**7.M.5.** Use ratio and proportion, including scale factors, in the solution of problems.

*Example: At the end of every second mile of the Boston Marathon, a typical marathon runner takes a four ounce cup of water. Instead of drinking all of the water, the runner sips some of it and then throws the rest on his or her head or body to cool off.*

*1. Assuming the typical runner drinks half of the water in the cup, how many ounces of water would an average runner drink during an entire 26.2 mile marathon? Explain how you found your answer.*

*2. Suppose that all of the runners in the Boston Marathon behaved like the "typical" marathon runner described above. About how many gallons of water would the 40,700 runners in the 1996 Boston Marathon have used? Record each step that you used to find your answer.*

*(See also7.NSO-N.1, 7.NSO-E.20)*

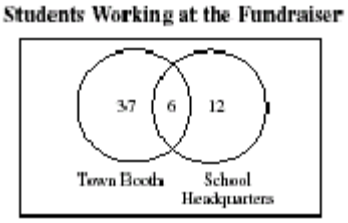
**Strand: Data Analysis, Statistics, and Probability**

**7.DASP.1.** Find, describe, and interpret appropriate measures of central tendency (mean, median, and mode) and spread (range) that represent a set of data.

**7.DASP.2.** Select, create, interpret, and use various tabular and graphical representations of data (e.g., circle graphs, Venn diagrams, stem-and-leaf plots, histograms, tables, and charts).

*Example: Last weekend, Lauren helped organize some students to participate in a fundraiser for charity. The students had a choice of working one shift at the information booth in town or one shift at the school headquarters. Students could also choose to work 2 shifts, one in town and one at school.*

*After the fundraiser, Lauren prepared a report for the school board. In her report, she drew the Venn diagram below to show where the students worked.*




*a) Based on the Venn diagram, how many students worked shifts at the Town Booth?*

*b) Based on the Venn diagram, how many students participated in the fundraiser?*

*c) Lauren could have drawn a bar graph to represent the same information as the Venn diagram. Create a bar graph that contains the same information as the Venn diagram.*

**7.DASP.3.** Describe the characteristics and limitations of a data sample. Identify different ways of selecting a sample (e.g., convenience sampling, responses to a survey, random sampling).

*Example: A class of 25 students is asked to determine approximately how much time the average student spends on homework during a one-week period. Each student is to ask one of his/her friends for the information, making sure that no one student is asked more than once. The numbers of hours spent on homework per week are as follows:*

*8, 0, 25, 9, 4, 19, 25, 9, 9, 8, 0, 8, 25, 9, 8, 7, 8, 3, 7, 8, 5, 3, 25, 8, 10*

*(a) Find the mean, median, and mode for these data. Explain or show how you found each answer.*

*(b) Based on this sample, which measure (or measures) that you found in part (a) best describes the typical student? Explain your reasoning.*

*(c) Describe a sampling procedure that would have led to more representative data.*

**7.DASP.4.** Use tree diagrams, tables, organized lists, and area models to compute probabilities for simple compound events (e.g., multiple coin tosses or rolls of dice).

*Example: Luis is going to toss two coins. What is the probability that he will get one head and one tail?*

**7.DASP.5.** Understand that the probability of either of two disjoint events occurring is the sum of the two individual probabilities and that the probability of one event following another, in independent trials, is the product of the two probabilities.

*Example: A bag contains 2 blue, 6 black, and 4 white socks. Paula is going to draw out a sock without looking in the bag. What is the probability that she will draw either a blue or a black sock?*